

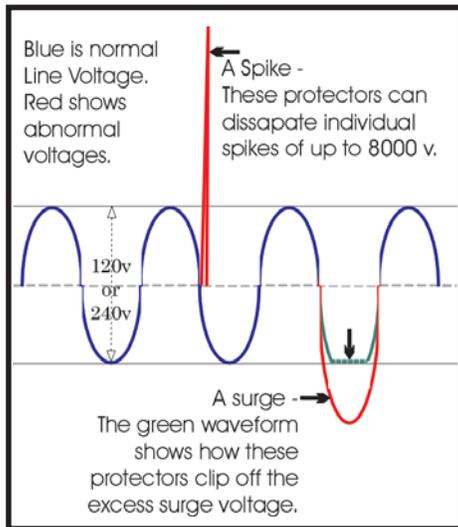
Some Technical Information for the VZPRO and X13PR ECM Motor Protectors

There have been some requests for Technical Information on Zebra's line of surge protection devices. Two of these devices, the VZPRO (for "standard" ECM motors) and the X13PR (for the "X-Motor" class) work to protect these expensive Variable Speed Motors from damage by "dirty" input power. This dirty power can be in the form of spikes, surges, and other transient voltages, as well as lightning strikes nearby.

Since the control modules for these motors include delicate electronics and processors, it is vital to insure that input power does not exceed nameplate recommendations - even for a moment - or some of the electronics may be permanently damaged, rendering the module useless.

General Electric Company's Motor Division (now GENTEQ Corporation), who has manufactured the vast majority of these motors, strongly recommends additional surge protection in situations where there might be surges, spikes or transient voltages. As most of the Technicians who service these motors have come to learn, this is a serious problem virtually *everywhere*. You can read about some of the options they have recommended at their dealer website: http://www.thedealertoolbox.com/files/Additional_Line_Transient_Protection.pdf **None of the suggestions listed there are as convenient, protective, and economical as Zebra's VZPRO and X13PR series of protectors.**

My motor says it has built-in protection. Why do I need this product? Variable Speed Motors often have *some* protection built in to the control module. No motor tested has protection as good as that found in the VZPRO or X13PR. Also, what do you do if the threshold voltage (described below) is exceeded and the internal protector fails? When that happens, the only option is to replace the module. *That's really what we were trying to prevent, isn't it?* It's far easier to simply plug-in a new VZPRO or X13PR, than it is to order (and wait for) a new module.



The VZPRO and X13PR protectors are *plug-in* devices - external to the motors - that intercept most voltage problems **BEFORE** they get a chance to do any damage to the motor or module. The chart at left shows what AC waveforms look like on an oscilloscope, and also shows what some damaging transients might look like.

The blue sine wave is normal AC voltage. Each complete wave (up and down) lasts 1/60th of a second. The red items are spikes and surges. The green line shows what happens to damaging voltages when the VZPRO or X13PR is in the circuit to protect the motors. (The green line, visible on the surge, can't be seen on the tall spike because of printing considerations, but it "clamps" the excess voltage to a value safe for the module and motor.)

The devices that Zebra's products use to stop these voltages are called MOV's (Metal Oxide Varistors) We use two of them for the best protection; one across each leg of the incoming line voltage and the ground. The typical response time for these solid-state devices to begin clamping off excess voltage is between 28 ms (milliseconds - millionths of a second) and 30 ms (milliseconds - thousandths of a second).

How do the protectors work? They react *only* when the voltage is above 135 volts on that leg with respect to ground. They convert the excess voltages into heat. Since they are inches away from the motor (which just happens to be in a fast moving airstream) they are actually able to be more effective than what their ratings claim. The VZPRO and the X13PR are pre-wired to protect both (either) 120 VAC and 240 VAC motors.

What exactly are their ratings? These devices are able to dissipate (turn into harmless heat) voltages as high as 8000 volts for one cycle of voltage (this is normally called a spike). They can dissipate lower voltages for much longer, say, a 2 second increase from 125 volts to 190 volts (commonly called a surge). Electrical items downstream from these protection devices simply never see the excess voltages.

What happens when voltages exceed the thresholds mentioned above? When that happens, these MOV's will fail. Their breakdown will cause the devices to short their poles together, permanently, and will cause discoloration of the device and its clear plastic package. This short will, in turn, cause the circuit breakers supplying the equipment to trip. They will continue to trip if reset. The sticker included with each product tells a Technician that if the device has failed and repeatedly trips the breaker, to not just *remove* the protector - but *replace* it - it has sacrificed itself so the motor would not be damaged.

So, it will protect the motor many times, right? Yes, it can block voltages thousands of times as long as they don't exceed the thresholds above.

Can it protect against a lightning strike to the building? A direct lightning hit to the building the equipment is installed in would probably arc over the device (and everything else there) and ruin the motor. A general rule is that if the lightning strike is on the *other side* of the utility transformer (i.e.: not struck between the utility transformer and the house or building), our devices usually save the motor.